



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
[www.uspto.gov](http://www.uspto.gov)

| APPLICATION NO.                     | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.         | CONFIRMATION NO. |
|-------------------------------------|-------------|----------------------|-----------------------------|------------------|
| 10/767,028                          | 01/28/2004  | Richard K. Williams  | M7207US5D                   | 4730             |
| 27906                               | 7590        | 10/21/2004           | EXAMINER                    |                  |
| PATENT LAW OFFICES OF DAVID MILLERS |             |                      | MALSAWMA, LALRINFAMKIM HMAR |                  |
| 6560 ASHFIELD COURT                 |             |                      | ART UNIT                    | PAPER NUMBER     |
| SAN JOSE, CA 95120                  |             |                      | 2825                        |                  |

DATE MAILED: 10/21/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

|                              |                        |                     |  |
|------------------------------|------------------------|---------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b> | <b>Applicant(s)</b> |  |
|                              | 10/767,028             | WILLIAMS ET AL.     |  |
|                              | <b>Examiner</b>        | <b>Art Unit</b>     |  |
|                              | Lex Malsawma           | 2825                |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM  
 THE MAILING DATE OF THIS COMMUNICATION:

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) Responsive to communication(s) filed on 28 January 2004.  
 2a) This action is FINAL.                    2b) This action is non-final.  
 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) Claim(s) 1-19 is/are pending in the application.  
 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
 5) Claim(s) 10-19 is/are allowed.  
 6) Claim(s) 1-5,8 and 9 is/are rejected.  
 7) Claim(s) 6 and 7 is/are objected to.  
 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) The specification is objected to by the Examiner.  
 10) The drawing(s) filed on 28 January 2004 is/are: a) accepted or b) objected to by the Examiner.  
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
 a) All    b) Some \* c) None of:  
 1. Certified copies of the priority documents have been received.  
 2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | Paper No(s)/Mail Date. _____  |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>20040128, 20040419</u> . | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
|   | 6) <input type="checkbox"/> Other: _____                                    |

## **DETAILED ACTION**

### *Claim Objections*

1. Claims 1 and 4 is objected to because of the following informalities:

At claim 1, in the last line, “regions” should read “region”; otherwise there would be a lack of antecedent basis.

At claim 4, line 1, “third layer” should read “third insulating layer”; otherwise there would be a lack of antecedent basis.

Appropriate correction is required.

### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-3 and 9 are rejected under 35 U.S.C. 102(b) as being anticipated by Hèbert et al. (5,567,634; hereinafter, “Hèbert”).

*Regarding claims 1-3 and 9:*

Hèbert discloses a method for fabricating a MOSFET, comprising:  
forming a hard mask 14 (comprising silicon nitride) on a surface of a semiconductor 10 (Fig. 1A);  
etching a trench 18 in the semiconductor through an opening in the hard mask (Fig. 1B and Col. 3, lines 5-6);

forming a first insulating layer 20 inside the trench (Fig. 1B);

introducing a gate material 22 (comprising polysilicon) into the trench, wherein the first insulating layer 20 is between the gate material 22 and the semiconductor 10 (Fig. 1B);

forming a body region 26 and a source region 28 in the semiconductor adjacent to the trench (Figs. 1C-1D and Col. 3, lines 23-28);

oxidizing the gate material to form a second insulating layer 24 overlying a remaining portion of the gate material, wherein the hard mask limits oxidation to areas that the hard mask exposes (Figs. 1B-1C);

removing the hard mask 14 to expose the source region 28 while the gate material remains protected by the second insulating layer 24 (Figs. 1C-1E);

depositing a third insulating layer (Col. 3, lines 30-33);

etching an opening in the third insulating layer to expose the source region 28 (Fig. 1E);

and

depositing a contact material 34 in the opening in the third insulating layer to thereby form a contact plug making electrical contact to the source regions (Fig. 1F). Therefore, these claims are anticipated.

***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Hèbert** (5,567,634) in view of **Yilmaz** (5,168,331).

*Regarding claims 4 and 5:*

Hèbert anticipates the method of claim 1 and further discloses the third insulating layer is deposited by flowing a low-temperature oxide (LTO) over a surface of the second insulating layer 24 and the semiconductor (Col. 3, lines 30-33). Hèbert **lacks** specifying a material for the LTO; accordingly, Hèbert lacks the LTO being specifically a layer of glass, or more specifically, a layer of glass comprising borophosphosilicate glass (BPSG). Yilmaz is **cited primarily to show** it was very well known in the art that BPSG is a very common LTO utilized in the art (note Col. 5, lines 11-13); therefore, it would have been obvious to one of ordinary skill in the art to modify Hèbert by specifically utilizing BPSG for the LTO because Hèbert does not specify any particular material for the LTO, i.e., one of ordinary skill in the art would have incorporated any

well-known LTO into Hèbert, since no specific material is disclosed; and given Yilmaz, it would have been obvious to incorporate BPSG since it was a very well-known LTO.

7. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Hèbert** (5,567,634) in view of Etou et al. (5,915,179; hereinafter, “**Etou**”).

*Regarding claim 8:*

Hèbert anticipates the method of claim 8 but **lacks** incorporating a barrier layer with the aluminum contact material 34. Etou **teaches** a method that incorporates a barrier layer 31 with an aluminum electrode 32 (Fig. 2A and Col. 3, lines 43-48), wherein the method allows a vertical MOSFET to be integrated with a Schottky barrier diode (Col. 1, lines 5-9). It would have been obvious to one of ordinary skill in the art to modify Hèbert by incorporating a barrier layer with the aluminum contact material 34 because such a modification would allow Hèbert’s vertical MOSFET to be integrated with a Schottky barrier diode.

***Allowable Subject Matter***

8. Claims 10-19 are allowable over the references of record.
9. Claims 6 and 7 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
10. The following is a statement of reasons for the indication of allowable subject matter:

Claims 6 and 7 would be allowable primarily because the references of record, singly or in combination, cannot fairly suggest depositing the metal contact material at a pressure of about two atmospheric pressures (as recited in claims 1 and 6).

Claims 10-19 are allowable primarily because the references of record, singly or in combination, cannot anticipate or render obvious the process steps, as recited in claim 1, for forming a metal contact to the source region, i.e., the metal contact must be formed by depositing metal into the opening in the second insulating layer, followed by planarizing the metal to form a plug coplanar with the surface of the second insulating layer, and then depositing a second metal layer over the plug. Incorporating such a metallization process with a “vertical/trench” MOSFET cannot be fairly suggested by the references of record.

### ***Conclusion***

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lex Malsawma whose telephone number is 571-272-1903. The examiner can normally be reached on Mon-Fri (8 hours between 5:30AM and 8:00 PM EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Lex Malsawma 

October 15, 2004



MATTHEW SMITH  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800